MEKELLE UNIVERSITY

DEPARTMENT OF ECONOMICS

COLLEGE OF BUSINESS AND ECONOMICS

WELFARE IMPACT OF THE CONDOMINIUM HOUSING PROGRAM IN MEKELLE

By:

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Declaration

I, **Mahder Halefom**, do hereby declare that the thesis entitled ***"Welfare Impact Of The Condominium Housing Program In Mekelle"***, submitted to the department of economics, Mekelle university in partial fulfillment of the requirement of masters of science in economics (development policy analysis), is my original work and it has not been presented for the award of any other degree, diploma, fellowship or other similar titles, in any other university or institution.

MAHDER HALEFOM MEHARI

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Date _____

Place: Mekelle, Tigray, Ethiopia

Certification

This is to certify that this thesis entitled ***"Welfare Impact of the Condominium Housing Program in Mekelle"*** is an authentic work of **Ms. Mahder Halefom** who carried out the research under my guidance. Certified further, to the best of my knowledge the work reported here in does not form part of any project report or thesis on the basis of which a degree or award was conferred on an earlier occasion on this or any candidate.

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Abstract

Since 2005, Ethiopia has been implementing a large-scale housing program which aims to reduce the housing supply shortage and improve the living standard of the urban low and middle income households through the construction of high-rise condominium houses equipped with basic services. This paper evaluates the impact of the condominium housing program on the welfare of the beneficiary households using a cross-sectional data from a sample of 335 households who applied for the houses, in Mekelle city.

To account for the selection bias due to differences in observable characteristics the PSM method is used. Moreover, to check the robustness of the impact estimates sensitivity analysis is applied.

The result shows that the program has a positive significant impact on wealth of household, approximated by a wealth index including housing quality, use of consumer durables and access to services, and on annual total education expense of households per attending child. The wealth index and the annual total education expense per attending child of the beneficiary households have increased by 0.23 to 0.25 and by Birr 502 to Birr 641, respectively. However, there is no statistically significant evidence as whether the program affects the other welfare indicators (monthly per capita food expenditure, incidence of sickness and children's educational attainment, as explained by highest level of children's schooling and by the proportion of school age children attending school). The sensitivity analysis on the significant outcome indicators shows that the estimations are robust to deviations from the identifying CIA assumption.

Key words**: **Mekelle, Condominium, Impact Evaluation, Sensitivity Analysis, Welfare

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Acronyms

ATT	Average Treatment effect on the Treated
ADLI	Agricultural Development Led Industrialization
BWUD	Bureau of Works and Urban Development
CBE	Commercial Bank of Ethiopia
CDF	Cumulative Distribution Function
CIA	Conditional Independence Assumption
CSA	Central Statistical Agency
DHS	Demographic and Health Survey
EPRDF	Ethiopian People's Revolutionary Democratic Front
FDRE	Federal Democratic Republic of Ethiopia
IHDP	Integrated Housing Development Program
MDGs	Millennium Development Goals
MHDA	Mekelle Housing Development Agency
MoFED	Ministry of Finance and Economic Development
MSEs	Micro and Small Enterprises
MWUD	Ministry of Works and Urban Development
NGOs	Non Governmental Organizations
PASDEP	Plan for Accelerated and Sustained Development to End Poverty
PSM	Propensity Score Matching
THDA	Tigrai Housing Development Agency
TNRS	Tigrai National Regional State
TV	Television
UN-HABITAT	United Nations Human Settlements Program
WMS	Welfare Monitoring Survey

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CHAPTER ONE

INTRODUCTION

1.1 Research Background

The stagnant nature of economic development and rapid population growth of most of the developing countries makes effective and efficient service delivery difficult for governments, to satisfy the need of their residents. Housing is one of the basic necessities for human survival; despite it remains for a long period as a critical problem of most of the cities of developing countries (Azeb, 2006). Development involves transformation of the spatial organization of a society (Bardhan and Udry, 1999). In the process of development, a nation becomes a more concentrated urban and industrial economy, from a dispersed, rural mostly agrarian society. According to them, a fundamental part of this transformation is the movement of a large number of people from the rural areas to the cities. This is due to the fact that agricultural production is land-intensive, requiring large area with relatively few labors, while industrial production requires relatively little land. This leads to the concentration of population in cities. In many poor countries, the speed of urban growth is very rapid (Bardhan and Udry, 1999).

Urbanization being twentieth century demographic phenomena, more and more people are changing residence from rural to urban areas. Studies have shown that increasing proportion of the population prefer large cities, big towns and a nearby administrative capitals. The growth of an urban center can take place in different forms (Gebeyehu et al., 2001): by growth of the existing urban localities, by classification of cities (from rural to urban areas) and annexations of new territory to existing cities and by demographic change, i.e. natural increase and migration effect. Many of the urban centers in Ethiopia have already faced one of these types of growth or a combination of them.

Ethiopia is one of the developing countries facing severe poverty. It is located in the horn of Africa with a total surface area of 1.016 million square kilometers (CSA, 1997) and with a population of around 84 million, as per July 2012, (see CSA). The country's economy is predominantly based on agriculture which accounts for 41% of GDP as per 2010/11 (MoFED,

2012). About 29.6 percent of the population (as per 2010/2011) lives under the poverty line which is the minimum level of income or expenditure deemed necessary to achieve minimum requirements of life (MoFED, 2012). Poverty in Ethiopia is more pronounced in rural areas as compared to the urban areas. 30.4 percent of the population in rural areas is poor whereas in urban areas it is 25.7 percent (MoFED, 2012).

Despite having one of the lowest proportions of urban population in the world at only 16.7 percent (MWUD, 2007), Ethiopia is rapidly urbanizing at a high annual growth rate of 4.3 percent. In seventeen years the urban population more than doubled from 6.4 in 1990 to 13.8 million in 2007. Ethiopia's urban growth rate is not the highest in Africa, but it is much higher than the 3.2 average for the continent and the same as the average for least developed countries (MWUD, 2007). The combination of high population and urban growth rates coupled with a high prevalence of urban poverty have placed enormous strain on Ethiopian cites. Ethiopian cities suffer from a high degree of homelessness, environmental degradation, and urban decay, a shortage of infrastructure and basic services, and high unemployment; urban unemployment is estimated to be 16.7 percent (MWUD, 2007). These factors combine to produce the critical urban issue: the lack of affordable, healthy housing for all sectors of the population.

Achieving Millennium Development Goal (MDG) 7, Target 11- improving the quality of lives of slum dwellers- is a major challenge. Only 30 percent of the urban housing stock is in good or fair condition (MWUD, 2007). This means that about 70 percent of the urban population lives in sub-standard slum housing that needs either complete replacement or significant upgrading. Moreover, the government estimates that the housing deficit is between 900,000 and 1,000,000 units in urban areas (UN-HABITAT, 2010). The housing deficit is set to increase concurrently with the foreseen high population and urban growth. Ethiopia's population is projected to more than double by 2050 to reach 170.2 million. To accommodate future growth, the Urban Sector Millennium Development Goals Needs Assessment (2004) predicted that to meet the MDGs in 2015 requires a total of 2,250,831 units, which equates to a considerable 225,000 houses per annum (MWUD, 2007). There is massive demand for serviced, healthy, affordable housing. This demand stems from both the current housing deficit and the poor quality of the existing kebele housing stock that is beyond repair.

The prominent current government approach to solving the low-income housing challenge is the Integrated Housing Development Program (IHDP), initiated by the Ministry of Works and Urban Development (MWUD) in 2005. The Program is a continuation of the 'Addis Ababa Grand Housing Program' which supported the endeavors of the Ethiopian Government in their implementation of the 'Plan for Accelerated and Sustained Development to End Poverty' (PASDEP). The IHDP aims to increase housing supply for the low-income population, recognize existing urban slum areas and mitigate their expansion in the future, increase job opportunities for micro and small enterprises and unskilled laborers, which will in turn provide income for their families to afford their own housing and to improve wealth creation and wealth distribution for the nation (MWUD, 2007).

Tigrai, one of the National Regional States of Ethiopia, has an area of 41,409.95 square kilometers (see CSA). According to the 2007 National Population and Housing Census by CSA, the population of the region is about 4.3 million, out of which 844,040 people live in the cities. The urbanization rate of the region is 4.3% per annum, similar with the rate at a country level. The same census shows that within the 74 cities in the region, there are 231,827 housing units and the average number of people per a housing unit is 3.6. In order to satisfy the goal of houses shown in the MDGs, about 200 thousand more houses are needed to be built. In Mekelle special zone, the capital city of the region, the population size is 273,459 as per 2012 (see CSA). In this town, there are 54, 710 housing units and the average number of persons per a housing unit is 3.8. The housing shortage of this town accounts to 38,000 houses. The IHDP aimed to build 19 thousand houses in this town to reduce the housing shortage by half in five years. . According to the city's Housing Development Agency, 1390 houses are actually built in the first project and all of the houses are spread to beneficiaries.

1.2. Statement of the Research Problem

Pro-poor programs are planned in order to achieve certain objectives and with an intention of helping a specific section of the population of a country, the poor. With this plan at hand the programs are implemented. In this case, it is important to assess whether the programs are (being) implemented in line with what is planned. In other words, it is of paramount importance to see whether the programs are correctly directed towards the targeted population and whether they are achieving the objectives intended to fulfill. This evaluation helps those concerned with the program to react to what is really happening. Particularly, measuring as accurately as possible the impacts of an intervention helps to understand the processes of intervention and their impacts so as to improve those processes (Hulme, 2000). Policymakers typically conduct impact evaluations of programs to decide how best to allocate scarce resources (Karlan and Goldberg, 2007).

Sustained high urbanization and population rates in Ethiopia will put extra pressure on already failing and deteriorated urban infrastructure, services, and housing stock. The massive housing needs are unlikely to be met by the small scale housing cooperative, government, and upgrading approaches prevailing from the late 1970s until the mid 2000s, especially considering the high demand by the low-income sector of the population for affordable housing. In response to this challenge, the Ethiopian government outlined an ambitious vision for low-income urban and housing development, formulated as the Integrated Housing Development Program (IHDP), since 2005, for all slums to be cleared within ten years time and for Ethiopia to be a middle-income country by 2025. In particular, the IHDP envisages the utilization of housing as an instrument to promote urban development, create jobs, revitalize the local urban economy through MSE (micro and small enterprise) development, encourage saving and empower urban residents through property ownership, and develop the capacity of the domestic construction industry.

The condominium housing program is currently being used in Ethiopia as a way to reduce the housing problem of urban low income people, among others. This method increases the access of the poor households to better quality housing at an affordable price. The program targets only

middle and lower income households (MWUD, 2007). It allows low-and-middle income households, who typically live in 'precarious' housing situations to access improved housing (UN-HABITAT, 2010). Through the construction of durable, fully-serviced housing units the program greatly improves their living conditions and their access to basic services. However, though the condominium housing program has become an increasingly important way for lower income people to own houses of good quality, knowledge about the achievement of these programs, specifically the effects of the program on the welfare of the beneficiaries, is partial. Thus, there is a need for rigorous quantitative evaluation of condominium housing programs regarding the welfare effects that can be attributed to the programs.

According to Lerman and McKernan (2008), the research on the impact of holding assets, among which housing can be taken as an example, on economic and social outcomes of families is limited. If the policy makers and researchers do not make efforts to determine who is being reached by the program and how these services are affecting their lives, it becomes difficult to justify the housing program as a tool for urban development. The condominium houses being built in Mekelle, which is the focus of this study, are not exceptional. Moreover, there has been limited effort to study the impact of the housing program on the life of the beneficiaries of the program. This study intends to contribute its share to the existing knowledge on impact evaluation of the housing program on the well-being of the beneficiaries in Mekelle.

1.3. Research Objectives

1.3.1Main Objective

The main objective of this study is to evaluate the impact, on household welfare, of living in a condominium house; so as to contribute to the understanding on the impact of housing programs in improving the life of low and middle income households.

1.3.2 Specific Objectives

With this statement of the general objective of the study, specifically the study tried to meet the following specific objectives:

- To investigate the impact of the condominium housing program on households' wealth.
- To evaluate the effect of the program on households' food expenditure.
- To assess the impact of the program on households' health status.
- To see the impact on the condominium housing on children's schooling.

1.4. Hypothesis

This study tried to test the following hypotheses using empirical data and the appropriate analytical tools.

H1: Living in condominium houses makes households wealthier.

H2: Living in condominium houses increases household per capita food expenditure.

H3: Living in condominium houses reduces the incidence of sickness.

H4: Having your own house increases educational attainment of children.

1.5. Significance of the Study

Karlan and Goldberg (2007) proposed the following reasons to evaluate, among others. First, by learning more about the impact on beneficiaries, one can design better products and processes. Second, impact evaluations allow program managers and policymakers to compare the cost of achieving a given impact by an intervention to the cost of achieving the same impact through other interventions. Third, impact evaluations are not simply about measuring whether a given program is having a positive effect on participants. Impact evaluations provide important information to practitioners and policymakers about the types of products and services that work best for particular types of beneficiaries. Exploring why top-performing programs have the impact they do can then help policymakers develop and disseminate best practice policies for other areas.

An impact evaluation helps to identify whether the program has any significant positive impact on beneficiaries or not and offer vital information about the prospective products and services that could satisfy their needs. In addition, impact evaluations provide grounds for policy-makers to promote the existing program or not.

This study has tried to uncover the welfare impacts of the program at household level with reference to the households in Mekelle, which in turn, contributes to the knowledge on the impact of the program, and tried to highlight important implications for other housing programs in Ethiopia and in other developing countries.

1.6. Delimitation/ Scope Of The Study

Currently, condominium houses are being used in different Ethiopian cities. In trying to achieve the research objectives, this study is conducted in Mekelle. The program was started after a decision was taken, in 2006, to implement the IHDP in regions of Ethiopia to address the problem of migration from rural areas to the urban centers at the source, and to potentially improve secondary cities.

The research mainly focuses on the welfare impact of the program as a result of solving the housing problem of the users, while the program has aims beyond this. Moreover, when measuring the well-being of the sample households some selected indicators are taken.

1.7. Limitation of the Study

Impact evaluations can be used either to estimate the impact of an entire program or to evaluate the effect of a new product or policy. In either case, the fundamental evaluation question is the same: how are the lives of the participants different relative to how they would have been, if the program, product, service or policy was not implemented? (Karlan and Goldberg, 2007) That is, how program participation, the new product or policy affects the outcomes of individuals. The first part of the question, how are the lives of the participants different, is the easy part. The second part, however, is not. It requires measuring the counterfactual, how their lives would have been had the program, product or policy not been implemented, since individuals can either participate or not in a given intervention, but they cannot do both at the same time. This is the

evaluation challenge. Moreover, during the data collection process, although it was tried to convince the respondents to respond to the questions, some of the respondents were not willing and it was not easy to find the households who applied for the houses but could not find, in trying to form the control group.

CHAPTER TWO
REVIEW OF LITERATURE

2.1. An Overview of Housing Conditions in Ethiopia

Housing has become an important public issue in almost all societies. Housing condition of a nation manifests the country's socio-economic development level. It also bears upon, according to many studies, the maintenance of privacy, health and the development of normal family living conditions.

According to the 2007 Population and Housing Census by CSA, in Ethiopia there are 15,103,134 housing units most of which, 12,206,116 units, are found in the rural areas and the 2,897,018 units are found in the towns of the country. Most of the housing units found in the towns, 836,074 units, are in the Oromia region. Out of the housing units found in the country, about 81.5 percent are owner occupied and around 9 percent of the units are rented from private households. In the urban areas, the owner occupied housing units account for about 39 percent and about 40 percent of the urban housing units are rented from private households. In Ethiopia, the average number of households per a housing unit is 1.044 and the average number of rooms per a housing unit is 1.8 (CSA, 2008). In urban areas of the country, the average number of rooms per a housing unit accounts for 2.1and the average number of persons is 3.9 per a housing unit. Applying the methodology used by Gebeyehu et al., (2001), in Ethiopia, based on the comparison between housing units and households, as registered in the 2007 Population and Housing Census, there is a surplus of 531,236 households who are in need of houses. In urban Ethiopia, following the same methodology, there is a surplus of 128,361 households.

In Ethiopia, especially in urban areas, shortage of housing is one of the major problems that call for immediate action. The majorities of houses in Ethiopia are below qualitative standard and lack adequate space (MWUD, 2007). The extent of provision of water supply, electricity, and drainage is minimal. The lives and health of people living in houses of such poor quality and with such inadequate provision for water, sanitation, and drainage are under continuous threat. Generally, in the developing world in general and in least developed countries like Ethiopia in

particular the number of people living in such conditions is higher. In terms of housing, regions and cities in Ethiopia have been attempting to deliver housing to their residents, but the strategies were unclear and the achievements are too small in comparison with the magnitude of the problem (MWUD, 2007).

Since the overthrow of the 'Derg' by the Ethiopian People's Revolutionary Democratic Front (EPRDF) in 1991, Ethiopia has been undergoing market-oriented reforms, structural adjustment policies, decentralization of governing structures, and a program of agricultural development led industrialization (ADLI). Following the new constitution and federal system of government in 1994 a rural development policy, named the Land Reform Program was introduced (UN-HABITAT, 2010). This program sought to decentralize urban planning responsibilities and to encourage secondary cities to attract rural migrants to ease pressure on the already limited housing available for urban dwellers in the major urban areas of the country.

According to UN-HABITAT (2010), the post 1991 housing sector can be typified by four characteristics: the private housing sector has not met the 'immense' housing demand, the practice of low-cost government owned rental housing continues to be the dominant low-income housing strategy, the housing stock is of very low quality, poorly maintained, and needs either replacement or significant upgrading and that the informal unplanned housing has increased rapidly as a result of high urbanization, limited housing supply, and the limited affordability of formal housing. In post-1991, it was assumed that the market mechanism of allocating urban land would alone solve the housing problem. However, the market mechanism has failed so far to deliver affordable houses to the majority of urban dwellers over the past years, and is not expected to respond to such huge housing needs in the near future. This fact has manifested by the 2004 MDG housing needs assessment. Thus, the government aims to achieve this MDG target of housing needs by delivering at least half of it (i.e. constructing 100,000 housing units per annum) and supporting the private sector to deliver the other half (support the construction of 125,000 housing units per annum by private home builders, housing cooperatives and real estate developers). In 2005, the Council of Ministers of the Federal Democratic Republic of Ethiopia formulated and approved a consolidated Urban Development Policy to link together the small scale efforts made by regional governments and cities since 2000 (UN-Habitat, 2008, cited in

UN-HABITAT, 2010). They also created the national Ministry of Works and Urban Development (MWUD) to guide the overall development of the country's urban areas. Furthermore, Ethiopia has designed a comprehensive housing development program in 2005 (MWUD, 2007).

2.2. Definition of Terms

CSA (2008) defines a **housing unit** as ''a separate and independent place of dwelling, either intended for residence or not intended for residence, but occupied as a living quarter by a household. A housing unit may be occupied by one or more households or may be used partly for living and partly for establishment whereas, residential housing unit is a housing unit used only for residence.''

"**Tenure** refers to the arrangements under which the household occupied its living quarters. A housing unit is said to be owner occupied, if the household owns it and it is free from rent. Whereas, a housing unit is considered as rented if the household living in it pays rent to a private individual or to Kebele office or to an Agency for the Administration of Rented Housing or to other Organizations'' (CSA, 2008).

The idea of **condominium housing** is a new phenomenon in Ethiopia. It is just as old as the IHDP (Ingwani et al, 2010). It emerged as a strategic response to rapid urban population growth, high prevalence of urban poverty, and urban unemployment in major Ethiopian cities; because only 30 percent of the urban house stock was regarded to be in fair condition. Condominium is defined in a variety of ways. A condominium is a building or a structure which has two or more stories consisting of parcels, owned and/or used separately by individuals and remaining portion of the property being owned by the owners of individual unit in common (Gajanayake, 2006 cited in Aryawansa et al., 2012). In other words, condominium housing is a name given in the form of housing tenure where each resident household owns their individual unit, but equally shares ownership and responsibility for the communal areas and facilities of the building, such as hallways, heating systems, and elevators. There is no individual ownership over plots of land. All

of the land on a condominium site is owned by all homeowners.[1] Informally, the term is often used to refer to the unit itself in place of the word "apartment". A condominium may be simply defined as "apartment" that the resident owns as opposed to renting. However, according to Wimalaratne (2005), cited in Senaratne et al. (2006), the word condominium does not apply to the type of unit itself, but the legal ownership arrangement.

In Ethiopia, under section 2 of the Condominium Proclamation No.370/2003, condominium means "a building for residential or other purpose with five or more separately owned units and common elements, in a high-rise building or in a row of houses, and includes the land holding of the building. Common elements refer to all parts of the condominium except the houses owned individually." In other words it defines condominium as a house built by regional housing development agencies, or previously built, that has common wall, ceiling and other common properties used for residence or for other purposes.

Generally, a condominium is a multiple-unit dwelling in which there is separate and distinct ownership of individual units and joint ownership of common areas. The building is managed by the condominium association, either directly or through a professional manager. The owners of the individual units are jointly responsible for the costs of maintaining the building and common areas, but they are individually responsible for the maintenance expenses of their particular units. A condominium can be an apartment, house, townhouse or a unit in an apartment house in which the units are individually owned. Hence, there is always common property owned with others-recreation areas, lawns, basement, garage as well as the individual units are owned outright.

There are several types[2] of condominium such as residential condominium, non-residential condominium, standard condominium and phase condominium. Residential condominium is owned by the individual units which the owner will occupy for living purpose. There is also non-residential condominium found in the property market such as hotel, services apartment, retail shop and office building. The structure is the same with the residential condominium but the difference is the usage of the building. Standard condominium is just a general type of condominium that can be found in any country. This kind of condominium is subdivided into

[1] See Wikipedia, the free Encyclopedia.
[2] See Wikipedia, the free Encyclopedia.

units and common area. Hence, this kind of owner will own different but inseparable entities. One is the well defined space that is used for residential purpose; one is the common area which the owner have shared interest on it.

Phased condominium is a condominium developed according to stages. The condominium development size increases from time to time until the development is complete. The advantage of this type is that the purchasers do not have to wait for so long for the development to complete.

Usually, the external maintenance of the roof and walls are undertaken by a Condominium Association that jointly represents ownership of the whole complex, employing strict management to ensure funding from each homeowner. This association consists of representatives of all condominium residents who manage the site through a Board of Directors, elected by Association members (UN-HABITAT, 2010). A register of condominium units and common areas on site and any restrictions on their use is commonly established in a Master Deed which authorizes the Board of Directors to administer condominium affairs and assess owners on their performance of adequate maintenance. Rules of governance are usually covered in a separate set of Bylaws which generally govern the internal affairs of the condominium blocks. Bylaws usually establish the responsibilities of the Condominium Association; the voting procedure to be used at Association meetings; the qualifications, powers, and duties of the Board of Directors; the powers and duties of the officers; and the obligations of the owners with regard to assessments, maintenance, and use of their unit and common areas. A set of Rules and Regulations, providing specific details of restrictions and conduct, are established by the Board and are more readily amendable than the Declaration or Bylaws. Typical rules include mandatory maintenance fees (often a monthly collection), pet and livestock restrictions, and color/design choices visible from the common areas of the buildings.

The maintenance of walls and features inside a condominium unit is the sole responsibility of the homeowners themselves (UN-HABITAT, 2010). This area is defined as the area bounded by the walls of the building, allowing the homeowner to make some interior modifications without creating an impact on the common areas. These boundaries are specified by a legal declaration, filed with the local governing authority. Anything outside this boundary is held in an undivided

ownership interest by a corporation established at the time of the condominium's creation. Condominium unit owners can be permitted to rent out their home to tenants, although leasing rights may be subject to conditions or restrictions set forth in the original declaration, such as a rental cap on the total number of units a community can lease at any one time, or otherwise as permitted by local law.

2.3. The Housing Program in Ethiopia

Ethiopia launched the second five year national strategic plan named as Plan for Accelerated and Sustained Development to End Poverty (PASDEP) in 2005/06. The urban strategy, in PASDEP, involves an approach that integrates initiatives to address poor housing quality, housing shortages and reduce slum areas in Ethiopia's main cities by 50% by launching a national Integrated Housing Development Program that scales up Addis Ababa's initiative, based on lessons learned, and which integrates public and private sector investment with micro enterprise development and provision of basic services. The integrated housing development program is the eighth core component of the PASDEP plan. The program is initiated by the Ministry of Works and Urban Development (MWUD) in 2005 with the aim of increasing housing supply for the low-income population, recognizing existing urban slum areas and mitigating their expansion in the future, increasing job opportunities for micro and small enterprises and unskilled laborers, which will in turn provide income for their families to afford their own housing and improving wealth creation and wealth distribution for the nation. IHDP is developed for all slums to be cleared within ten years time and for Ethiopia to be a middle-income country by 2025 (MWUD, 2007). In particular, the program envisages the utilization of housing as an instrument to promote urban development, create jobs, revitalize the local urban economy through MSEs development, encourage saving and empower urban residents through property ownership, and develop the capacity of the domestic construction industry (MWUD, 2007).

The Integrated Housing Development Program targets only middle and lower income households (MWUD, 2007). It aims to benefit low and middle income urban residents who do not own a house. These sections of the community are hard hit by inadequate and poor quality housing in bigger cities and towns. Such targeting would also help to ensure sustainability and equitable distribution of wealth in cities and towns. Moreover, the IHDP aims to ensure equitable

distribution of wealth and to economically empower women. According to the program at least 20 percent to 30 percent of housing units are to be allocated to female headed households (MWUD, 2007). In addition, urban women are entitled to benefit from the allocation of the remaining 70% to 80% of the houses constructed like any other urban resident. Women are also expected to benefit from the jobs and small businesses created. And the youth have equal opportunity to participate in the program. The initial goal of the housing development program, during the four year program period 2006/7 to 2009/10, was to construct 360,000 condominium units (MWUD, 2007). The provision of housing units aimed to reduce 'urban sprawl' and followed the strategy of lower costs of providing new infrastructure by targeting underutilized land. The program also targeted to create 200,000 jobs, promote the development of 10,000 micro- and small- enterprises, enhance the capacity of the construction sector, regenerate inner-city slum areas, and promote homeownership for low income households.

MWUD transferred the overall responsibility to regional states concerning implementation of urban development and urban good governance packages. In most regions, the Bureau of Works and Urban Development (BWUD) has become responsible for urban management and development issues. Regarding the Integrated Housing Development Program, main implementing agencies, of the targets of the program, are the Regional Housing Authorities (MWUD, 2007). Following this, housing development agencies have been established in different regions of the country and Tigrai Housing Development Agency (THDA) is one of them. THDA is established by the Proclamation No.109/1998 with the mission to build affordable and quality houses, encourage the construction industry of the region by participating different contractors and bring high employment opportunities by participating Micro and Small Enterprises.[3] At the beginning, the project was established for four years life to build residential houses and other governmental buildings. Hence, the project has started at seven big branch towns of the region: Mekelle, Adigrat, Adwa, Axum, Shire, Humera and Maichew which are called 1999 projects. And by the next year it expanded its branch offices to twelve towns by adding five towns (Alamata, Korem, Wukro, Abiyi Adi and Sheraro). The latter added are called 2000 projects. The IHDP targeted to build 4070 housing units in Tigrai in five cities by 2006/07 and 5698 housing units in seven cities of the region by 2007/08 (MWUD, 2007).

[3] See www.tigraiagency.gov.et

According to MWUD (2007), IHDP is formulated to directly contribute to achievement of Millennium Development Goals. Specifically, MDGs one, three and seven which are about eradicating extreme poverty and hunger, promoting gender equality and empowering women and ensuring environmental sustainability, respectively.

The Ethiopian Integrated Housing Development Program is an ambitious program that directly addresses the pressing low-income housing challenge. It is a large-scale approach to addressing the current housing deficit, the poor quality of the existing housing stock, and the future housing needs due to continued urbanization. The program allows low- and middle-income households, who typically live in precarious housing situations to access improved housing. Through the construction of durable, fully-serviced housing units the program greatly improves their living conditions, security of tenure, and access to basic services. Importantly, the program has facilitated access to credit for the low-income sector of the population (MWUD, 2007), through the Commercial Bank of Ethiopia (CBE), where previously there was a very limited opportunity for low-income households to secure credit for improved housing. It highlights government and local authority's commitment to addressing housing affordability for the low-income sector of the population and improving the living conditions of the low-income urban dwellers to meet the MDGs and reduce urban slum prevalence rates in Ethiopia.

Under the proclamation for condominium, in Ethiopia, buyers of condominium houses are required to make a down-payment, which is first payment as a percentage of the total payment, before they receive the house. The down-payment percentage varies according to the unit type and size of the houses: studio- fifteen percent, one-bedroom- twenty percent, two-bedroom- thirty percent and three or four-bedroom- fifty percent. After making the down-payment the rest price of the house are paid within a delimited time period which varies according to the house: twenty years for studio and one-bedroom, fifteen years for two-bedroom and ten years for three or four bed-room. Beneficiaries enter into a contractual loan agreement with the CBE on the basis of monthly interest and principal repayments. The project finance structure aims to cross-subsidize the studio and one-bedroom units as a pricing strategy to increase affordability for low-income households. Studio and one-bedroom units are sold lower than their individual

construction costs and two- and three-bedroom units are sold higher than their individual construction costs. The subsidy percentages are: studio -30 percent, one-bedroom -10 percent, two-bedroom +5 percent, and three-bedroom +10 percent of the unit construction cost. No credit or income checks on potential beneficiaries are undertaken (UN-HABITAT, 2010). The assumption is that if beneficiaries have the financial capacity to meet their mortgage obligations, they will do so. If not, they will rent out their unit and finance the mortgage through this income.

The IHDP was envisaged as a national housing program to meet national housing demand. Accordingly, in 2006 a decision was taken to implement the IHDP in the nine semi-autonomous administrative regions of Ethiopia (UN-HABITAT, 2010). It was thought that this action would address the problem of migration from rural areas to the urban centers at the source, and potentially improve secondary cities, whilst acting "as a preventive measure against slum development". Methodologies and guidelines were drawn from Addis Ababa's experience of the program, and adapted to suit the regions. As of mid-2010, the program had built a total of 69,921 units in the regions of Ethiopia, of which 22,699 have been transferred (UN-HABITAT, 2010). However, the IHDP has been suspended in the regions for a variety of reasons. The condominium blocks have been described as 'an eyesore' in the smaller low-rise provincial towns and demand has been low due to considerably lower purchasing power in the regions than in Addis Ababa.

A study made by UN-HABITAT (2010) showed that the IHDP has been successful in many respects. The program has greatly increased the number of homeowners that would never otherwise have owned a home within their lifetime, and, in parallel, has benefitted the housing market by increasing the supply of owner occupied housing and rental units. The program has also built the capacity of the construction sector, addressed the existing slums been a significant generator employment opportunities. There are, however, a number of unanticipated challenges facing the program identified by UN-HABITAT (2010). One of the most pressing is the affordability of the units for low-income households, with the cost increases in the price of condominium houses deeming them no longer an option for many low-income households. Furthermore, the inability to pay the monthly mortgage and service payments forces many

households to move out of their unit and rent it out rather than risk losing it through bank foreclosure.

2.4. Empirical Evidence

Affordable and stable housing has been linked with improving health, education and economic outcomes for families and children. Many studies show that stable housing is both a foundation for well-being as well as a platform for connecting people to services and resources that include quality health care centers and schools and other facilities. When housing is stable and affordable, families can spend more time and resources on medical care, nutritious food and the like. Homeownership increases housing security to families: it gives more control to owners over their physical surroundings, lowers real monthly payments over time, protects against unanticipated changes in rental costs, and helps build wealth. Homeownership also provides a ready mechanism for families to borrow money and get credit to improve their home, make purchases or invest in education or the financial markets. It is also argued that these benefits are available to all homeowners regardless of economic status.

A central role of assets, like home ownership, is to cushion the decline in consumption that might otherwise arise with a sudden income loss (Lerman and McKernan, 2008). Families can draw down their assets or use assets as collateral to borrow and replace lost income, thus potentially experiencing a smaller loss in consumption.

Conceptually, enhanced family and residential stability derived from asset holding are likely to help children improve their educational outcomes and feel more rooted in their community (Lerman and McKernan, 2008). A relatively large empirical literature suggests that homeownership improves children's educational attainment and decreases teenage pregnancy, among other potential effects. McDonald et al. (2007) also argue that there is a significant relationship between housing and children's educational achievement.

The empirical literature presents some evidence that assets positively affect health and psychological well being in a causal way. More studies find a positive association between assets and health and psychological well-being. By helping people meet unanticipated health care costs

and thus encouraging them to seek appropriate diagnosis and treatment, assets can improve health outcomes (Lerman and McKernan, 2008). According to McDonald et al. (2007), are three main ways in which housing affects health. The physical characteristics and quality of homes produce environmental effects that may result in health problems. Unstable housing may affect access to health care and may also have mental health effects. High housing costs may affect how much the household spends on other essential items such as nutrition and health care, which may result in health problems. Moreover, considering the relationship between housing costs and health effects, they concluded that low-income households who incur high housing costs spend much less on food and health care as compared to equivalent low-income households with affordable housing.

Strong evidence suggests that the average homeowner accumulates a significant portion of wealth in the form of housing equity. Wealthy homeowners also accumulate more non-housing wealth than renters, suggesting that they save more. McCarthy et al. (2001) argue that homeownership brings significant economic benefits to both the families that choose to be owners and society in general. Homeowners live in larger, higher-quality dwellings. They enjoy a better stream of housing services, with costs that usually fall over time, and stand to gain considerable financial returns if they remain owners for a long time.

Marcano and Ruprah (2008), in their study of impact of Chile's housing program using Propensity Score Matching, found that the program had significant positive effects on materiality conditions (access to water, sewerage, and electricity), but it had a negative effect on overcrowding (number of person per room). However, their study shows that the program has no significant effects on welfare indicators (poverty, school attendance, occupation ratio, etc.). In other words, their result shows an unambiguous improvement in the quality of the housing solutions. However, the impact on other outcomes is doubtful. According to them this could be due to high residential segregation that resulted from attempting to maximize the number of housing solutions on the cheap.

In addition to the welfare impacts, homeownership also contributes to economic development. According to McCarthy et al. (2001), increasing homeownership is a central strategy for successful economic development.

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter deals with a description of the study area. Data collection mechanism and methodologies for analyzing the impact of the condominium housing program are also presented.

3.1. Area Description and Sampling

The study is about condominium housing program in Mekelle. Mekelle, the capital city of the National Regional State of Tigrai, is regarded as a zone of its own. In Mekelle special zone, the population size is 273,459 as per 2012. In this town, there are 54, 710 housing units and the average number of persons per a housing unit is 3.8. The housing shortage of this town accounts to 38,000 houses.

In the main area of the study, which is Mekelle, there are types of households. The first are those who are not beneficiaries of the housing program and the other households are those who are beneficiaries of the housing program and already owning condominium houses. The survey considered a total sample size of 335 households, 150 from the beneficiary households, and 185 from the eligible non-beneficiary households, to be used as a comparison group. According to Rosenbaum and Rubin (1983), to have an adequate sample for the matching the size of the comparison group should be larger than the size of the treated group.

In trying to draw the sample of households random sampling method is used. Both groups of households are taken from the households who applied for the houses. According to the city's housing development agency, a total of 14,649 households applied for the houses, in the first project of the housing program: the 1999 project. Out of these households, only 1390 households: 829 male headed households and 561 female headed households got the houses. Accordingly, the sample of 150 beneficiary households, which is about 11 percent, is randomly drawn from the list of these beneficiary households. The sample of non-beneficiary households is also randomly drawn from the list of the 13,259 households who did not get the houses. The beneficiaries are the households owning, and living in, condominium houses and the non-

beneficiaries are those households who are unable to find the houses because of the computer lottery method and are living in rented houses.

3.2. Data Source and the Field Work Procedure

The data used in this study is mainly primary. The data collection process is undertaken through a face to face interview with the household heads using a questionnaire. A total of 335 households are included in the study. The study also encompasses secondary data from regional and national (MoFED, MWUD and CSA) documents and some official documents about the program.

A standardized questionnaire is prepared to collect data and three enumerators were hired for this purpose. The researcher participated in the data collection process as a supervisor. The content of the questionnaire includes all the variables which are very important for evaluating the welfare effects of the condominium housing program in the study area. Accordingly, it is designed to comprise the following sections. Household characteristics: with a focus on gender, age, marital status, educational level and employment status of the household head and the monthly income and size of the household. There are also sections about the housing conditions, materiality conditions and living standard of the household.

After designing the questionnaire, training is given to the data collectors on the questions included in the questionnaire and how to complete the questionnaire. The collected data are entered to STATA, version 12, software.

3.3. Method of Analysis

Both descriptive and econometric analyses are held in this study to achieve the intended research objectives.

3.3.1. Descriptive Analysis

The descriptive analyses used in this study are percentages, tables and statistical tests like t-test. The t-test is helpful so as to compare participants and non participants using their simple mean difference by binary values. In addition, the t-test is used to assess the covariate balancing of the matching method.

3.3.2. Impact Evaluation Design

Evaluating the impact of a program requires measuring the impact of receiving the program's services versus the counterfactual of not receiving the services. Constructing a counterfactual that would allow observing the potential outcomes of program participants had they not participated is the main challenge of every evaluation study (Karlan and Goldberg, 2007). Such comparison requires finding an adequate control group which would allow a comparison of program participants with non-participants.

Various methods exist to reduce bias in impact evaluation. The essential problem these methods address is that the outcome for participants if they had not participated is not observed. So evaluation is essentially a problem of missing data (Ravallion, 2001). A comparison group is used to identify the counterfactual of what would have happened without the program. The comparison group is designed to be very similar to the treatment group of participants with one key difference: the comparison group did not participate. One of the main methods available is matching based on propensity score (Ravallion, 2001).

Matching has become a very popular technique in the area of development economics in recent years. Matching is a method of sampling from a large reservoir of potential controls to produce a control group of modest size in which the distribution of covariates, observable characteristics, is similar to the distribution in the treated group (Rosenbaum and Rubin, 1983). It is, thereby, a technique of dealing with selection bias by estimating the counterfactual or unobserved outcome of program participants from the outcome of nonparticipants who possess similar traits in terms of observable characteristics. It is based on the idea that the best estimate of the counterfactual outcome is to find the best match from the eligible control group in terms of observable characteristics. In other words, the aim of this method is to find the closest, in terms of observable characteristics, comparison group from a sample of non-participants to be matched with the sample of program participants (Ravallion, 2001). In terms of this study, it implies that by matching a household or households living in condominium house to those in the control group, we can estimate the counterfactual outcome and ultimately estimate the effect of the housing program.

Propensity score matching (PSM) method has been specifically designed to assist researchers in drawing causal inferences in observational studies. PSM helps to adjust for initial differences between a cross-section of participant and non-participant groups by matching each participating unit to a non-participant unit based on ‘similar’ observable characteristics. An advantage of PSM is that it summarizes all the differences in a single dimension, the propensity score, which is then used to compute treatment effects. Propensity score is a conditional probability of assignment to a particular treatment given a vector of observed covariates (Rosenbaum and Rubin, 1983). It summarizes the conditional probability of participation given pre-treatment or exogenous characteristics and, as a probability measure, its value ranges between zero and one ($0<P(x)<1$). It can be computed as (Becker and Ichino, 2002):

$$P(x) = \Pr\{D = 1 \mid X\}$$
$$= E\{D \mid X\} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

where D and X refer to participation dummy and a vector of pre-treatment control variables respectively.

According to Rosenbaum and Rubin (1983), both large and small sample theories show that adjustment of the scalar propensity score is sufficient to remove bias due to all observed covariates. The matching of participants with non-participants using propensity score can significantly reduce bias. It is estimated by using probit (or logit) regression of observed data (Rosenbaum and Rubin, 1983 and Ravallion, 2001). The covariates in the model are non-treatment variables such as the participants’ background characteristics. This estimated propensity score abstracts the information of these covariates.

Using such estimated propensity scores, a researcher can match a participant from the treatment group with a non-participant from the control group, so that the treatment group and control group can be balanced to facilitate causal inference. Because the propensity score is just one number, it is far easier to control for it than covariates, X, which could be many variables (Ravallion, 2001). An important feature of the PSM method is that, after units are matched, the

unmatched comparison units are discarded and not directly used in estimating the treatment impact. Ideally, the households representing one matched pair are identical to each other except for their living in a condominium house, in this case. As a consequence, this approach isolates the impact idiosyncratic factors have on outcome variables by reducing observed heterogeneity between beneficiaries and non-beneficiaries.

The basic idea of matching is to compare a participant with one or more non-participants who are similar in terms of a set of observed covariates, X. In a next step, the differences in outcome variables for participants and their matched nonparticipants are calculated, i.e. the average treatment effect on the treated (ATT) is the mean difference between participants and matched non-participants. It is also called conditional mean impact, conditional on participating in the program (Ravallion, 2001). ATT can be estimated as shown below (Becker and Ichino, 2002).

$$\begin{aligned} ATT &= E\{Y_{1i} - Y_{0i} \mid D_i = 1\} \\ &= E\{E\{Y_{1i} - Y_{0i} \mid D_i = 1, P(X_i)\}\} \\ &= E\{E\{Y_{1i} \mid D_i = 1, P(X_i)\} - E\{Y_{0i} \mid D_i = 0, P(X_i)\} \mid D_i = 1\} \ldots\ldots\ldots (2) \end{aligned}$$

Where the outer expectation is over the distribution of $(P(X_i) \mid D_i{=}1)$ and Y_{1i} and Y_{0i} denote outcome in the absence of participation and outcome of participation respectively.

Matching estimators are developed based on the Conditional Independence Assumption (CIA), also called unconfoundedness (Becker and Ichino, 2002), which is the key assumption made by all comparison group methods (Rosenbaum and Rubin, 1983 and Ravallion, 2001). This assumption states that participation and outcome are known to be conditionally independent given control variables, covariates, (X_i's):

$$(Y_0, Y_1) \perp D \mid X \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. (3)$$

In other words, this assumption states that selection is solely based on observable characteristics and potential outcomes are independent of treatment assignment. Meaning, under this

assumption, the participants' mean outcome had they not participated can be simulated by non-participants' mean outcome. Then, it follows that

$$E\{Y_0|X, D=1\} = E\{Y_0|X, D=0\} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

This assumption must be maintained in order to produce unbiased PSM estimates (Becker and Ichino, 2002).

Using their assertion that 'treatment assignment is strongly ignorable' which means that every unit in the population has a chance of receiving treatment, Rosenbaum and Rubin (1983) show that, for non-randomized observations, outcome and treatment are conditionally independent given the propensity score, P (x), which is the conditional probability of receiving treatment given pre-treatment characteristics:

$$(Y_0, Y_1) \perp D \mid P(x) \ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

A Balancing Condition needs to be satisfied for propensity score matching. The balancing condition shows the conditional independence of participation in terms of control variables given the propensity score (Rosenbaum and Rubin, 1983):

$$D \perp X \mid P(x) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. (6)$$

Alternatively, the balancing condition indicates that for individuals with the same propensity score assignment to treatment is random. Thus, if the balancing condition is satisfied, observations having the same propensity score will have the same distribution of observable characteristics irrespective of treatment (Becker and Ichino, 2002). This implies that with the help of the propensity score, treatment is virtually randomized and, as a result, treatment and control group members will on average be observationally identical.

Another condition in PSM is the Common Support requirement (Heckman et al, 1998 in Ravallion, 2001) also called the assumption of overlap, which ensures that individuals compared

with the participant and non-participant groups are, to begin with, comparable. Specifically, it ensures individuals with the same observable characteristics have a positive probability of being in both participant and non-participant groups. This requirement can be imposed such that estimation is performed on individuals that have common support. Finally, the assignment mechanism can be interpreted as if, within subpopulations of units with the same value for the covariate, completely randomized experiment was carried out. Data from subsamples with the same value of the covariates can be analyzed as if they came from a completely randomized experiment. The average treatment effect on the treated (ATT) is therefore given by the difference in mean outcome of matched participants and non-participants that have the common support conditional on the propensity score.

3.3.3. Estimation Strategy

Estimation of ATT using PSM involves three basic steps: computing the propensity score, matching on the basis of the propensity score, and obtaining the treatment effect as a difference of the mean outcomes of participants and non-participants from the matched observations. The steps could further be subdivided to provide a complete picture on how to estimate impacts using PSM (Ravallion, 2001):

i. Obtaining a dataset of sample program participants (treated) and eligible nonparticipants (control) and pooling the two together. The larger the sample of eligible non-participants, the better it will facilitate better matching. Data on participants and nonparticipants should be collected using the same questionnaire and at the same time;
ii. Running a participation model using logit regression, using the vector of control variables to determine participation;
iii. Computing the predicted values of the probability of participation (propensity score) for each participant and non-participant;
iv. Dropping observations outside the region of common support. Here observations in the control or treatment group whose probability of participation does not match with their counterparts in the other group will be dropped;

v. Matching observations based on their propensity score. Here observations in the treatment sample are matched with observation in the control sample with the closest propensity score;
vi. Computing the mean difference between the outcome of the treated subjects and that of the control units once the matching is executed. This difference provides the effect of treatment for the matched units; and
vii. Finally, averaging the mean of the individual effects and obtaining the overall average treatment effect on the treated

Propensity score matching is used to identify impact. According to Ravallion (2001), there are two distinct sources of bias, that due to differences in observable characteristics and that due to unobservable characteristics. The objective of the PSM technique is to account for selection on observables. It is a better method of dealing with the differences in observable characteristics. But, the selection of unobservable variables, which is driven by unobserved variables that influence both treatment decisions and potential outcomes, remains unaccounted for (Ravallion, 2001). As explained earlier, PSM is based on a strong identifying assumption, the unconfoundedness assumption, which states that the researcher should observe all variables simultaneously influencing the participation decision and outcome variables (Becker and Caliendo, 2007). Hence, sensitivity analysis should be undertaken to check the sensitivity of the estimated results with respect to deviations from this assumption (Becker and Caliendo, 2007 and Nannicini, 2007). That is, Sensitivity Analysis should be undertaken to gauge the vulnerability of the assignment process into treatment to unobservable variables, and hence explore whether the matching estimates are robust to selection on unobservable variables.

The next practical steps are followed to implement the PSM technique in this paper. The first step is to predict the propensity score for each group using a logit model. Justifying the CIA requires that only variables that simultaneously influence the participation decision and outcome but that they are not affected by participation, according to Ravallion (2001) are included. In this study, the covariates, the variables that affect participation in the housing program include number of household members, age of the household head, education of the household head,

monthly family income, gender of head of the household, marital status of the household head and employment status of the household head.

The second step is to choose a method by which weights are assigned for matching. As a measure of probability of participation, the propensity score is a continuous variable and we can hardly expect two or more observations to possess exactly the same propensity score. Hence, with exact matching not possible, we resort to inexact matching where we match observations on the basis of closeness of their propensity scores. Various methods[4] have been proposed in the literature and four of the most widely used are Nearest Neighbor Matching, Radius Matching, Kernel Matching and Stratification Matching (Becker and Ichino, 2002). These methods differ from each other with respect to the way they select the control units that are matched to the treated, and with respect to the weights they attribute to the selected controls when estimating the counterfactual outcome of the treated. In this study, four of these matching algorithms are used.

The Stratification method consists of dividing the range of variation of the propensity score in intervals such that within each interval treated and control units have on average the same propensity score and within each interval, the difference between the average outcomes of the treated and the controls is computed. Finally, the ATT is obtained as an average of the ATT of each block. One drawback of this method is that observations in blocks where either treated or control units are absent are discarded. The Nearest Neighbor method is an alternative way to match treated and control units, which consists of taking each treated unit and searching for the nearest neighbor control unit. And in this method a control unit can be a best match for more than one treated unit. In Radius matching, each treated observation is matched with those control observations that fall within a pre-specified area (radius) of the propensity score of the treated observation. Kernel matching considers all treated and control units. Under this matching algorithm, all treated observations are matched with a weighted average of all control observations with weights that are inversely proportional to the distance between the propensity scores of treated and control units. According to Becker and Ichino (2002), none of these methods is superior to the others and, thus, a joint consideration of them improves robustness of the estimates.

[4] The formula for each matching estimators are presented in Appendix B.

Once the propensity score is estimated and used to compute the matching, the third and critical step is to perform a 'balancing test' to check if the matching procedure was effective, to test if matching balanced observable covariates across treated and control groups. A t-test for equality of means in the treated and control households suggests the extent to which the difference in the covariates between the treated and control groups have been eliminated so that any difference in outcome variable between the two groups can be inferred as coming mainly from the treatment.

Another issue of significance in impact evaluation, in addition to controlling for selection bias, is the factors that need to be used as indicators of impact. Impact evaluation would thus involve measuring changes to the outcome of interest as a result of the treatment under consideration. Official government documents do not explicitly list the expected program outcomes other than the reduction of overcrowding and the improvement of the quality of housing. The set of outcomes used in this study consists of four welfare indicators: wealth of households, food expenditure of households, health status of households and education attainment of children (4-18years old).

In measuring welfare of the households, one of the indicators used is wealth of the households. Household wealth, following Woldehanna et al. (2008) and Woldehanna et al. (2011), consists of housing quality, consumer durables and access to services and is approximated by wealth index[5]. Physical characteristics of a household's environment are important indicators of the socio-economic status of households (CSA and ICF, 2012). These characteristics include the housing characteristics, household possessions of durable goods and access to services. In the wealth index, the housing quality reflects the welfare of the household members in the sense of comfort related to their housing which includes the number of rooms in the housing unit and whether the housing unit has a separate kitchen and a separate children's room. CSA (2008) defines a room "as a space enclosed by walls reaching from the floor to the ceiling or roof at least to a height of two meters and having an area of at least four square meters. Except for bathrooms, toilets and passage ways all other rooms found in the housing unit are considered as rooms." The consumer durables shows the household members' use of durable goods (Radio, Tape, TV, Fridge, modern

[5] Appendix C describes the method used for calculation of the index in detail.

bed, Table, Chair, Electric 'mitad', Stove, Sofa set, Closet, Cupboard, Mobile phone and Landline phone). Access to services considers the access of the household to potable water, electricity and sewerage connections and the cooking fuel they use. These are aggregated into a composite non-weighted wealth index. The wealth index takes a value between zero and one, with a higher value reflecting higher household wealth.

Another welfare indicator used is food expenditure of the households. Food expenditure[6] of the households is measured by monthly food expenditure per capita. According to Rutstein and Kiersten (2004), expenditures need to be adjusted for size and age structure of the household through the calculation of the number of adult equivalent members to properly represent the household's economic position. Thus, in this study, the monthly food expenditure of the households is adjusted to the size and age and gender structure of the households.

In addition to the above welfare indicators, the effect of the program on health of the household members is also assessed. Following CSA (2012), the incidence of sickness is used to measure the health status of the households. The households are asked whether they had at least a member sick at least once over the 12 months period prior to the date of interview.

Another indicator used to measure the effect of the program on the welfare of the households is children's schooling. This outcome is measured by three dimensions: highest years of schooling of children, the proportion of school age children attending school and by annual total education expense per attending child. Although the minimum age for schooling in Ethiopia is age 7 (CSA, 2011), some children are enrolled at younger ages and in urban areas children go to kindergarten starting at age of 4 years. Thus, in this study, children 4-18 years old are considered as school age children.

[6] The adult equivalent rate used to calculate the food expenditure per adult equivalent is presented in Appendix C.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter presents the descriptive results and the empirical findings of the impact evaluation survey. Both descriptive and econometric tools are used while analyzing the data. In the descriptive analysis, an overview of the household characteristics is undertaken. Moreover, some descriptive analysis of the welfare indicators selected as outcome indicators for the impact evaluation has been done. And both groups of the beneficiary and comparison groups are compared based on these welfare indicators before running the matching method.

In the econometric analysis, the matching technique is used in order to achieve causal inference of participating in the housing program and changes in welfare of households indicated by some selected outcome indicators. Furthermore, to check whether the matching estimates are only due to the program or due to some other unobserved characteristics, that lead to differences between the two groups even in the absence of the program a sensitivity analysis is executed.

4.1 Descriptive Analysis of the Survey Data

The analysis is based on a cross-sectional data which comes from households in Mekelle, capital city of the National Regional State of Tigrai. According to CSA, in EDHS, 2011, a household is defined as a single person or a group of related or unrelated persons who live together in the same dwelling unit or in connected premises, who acknowledge one adult member as head of the household, and who have common arrangements for cooking and eating. The same definition is followed in this study.

The survey involves a total of 335 sample households drawn using random sampling technique from the target population. Following Karlan and Goldberg (2007) the sample contains treated and control households. All the households in the sample are those who applied for the houses. The beneficiaries are made up of households who got condominium house and are living in the houses and the households who applied for the houses, but could not get the houses, and who are

still living in rented houses are considered as comparison group. Respondents are heads of the households and are surveyed on several household characteristics and some welfare indicators.

Data about age of the household heads in the sample show that the average age is 40 years and it ranges from 20 to 83 years. The level of education of the sample household heads (measured as years of schooling) stretches from 0-17 years of schooling. Most of the household heads have completed 12^{th} grade.

Ethiopian households consist of an average of 4.8 persons (CSA, 2012). The average family size (including relatives, permanently living with the family, and servants) of the sample households is 3.64 and ranges from 1 member to 9 members. 38 (11.34%) of the respondent households have one member and only one household has nine members. Majority of the households have four members in their family. As far as the number of children (18 years old and younger) in the sample households is concerned, the average number of children is 1 and the maximum number of children in the households is 5. Looking at the monthly family income (in Birr) of the households in the survey, the average income is Birr 3093.55 ranging from Birr 400 to Birr 9000 per month.

Table 4.1 Summary statistics of variables used in the Propensity Score Matching (Partial)

Variable name	*Mean*	*Std. dev.*	*Min*	*Max*
Living in a condominium house	0.45	0.49	0	1
Age of household head	40	10.70	20	83
Education of household head	9.77	4.83	0	17
Family size	3.64	1.52	1	9
Monthly family income	3093.55	1394.28	400	9000

Source: Author's own calculations, 2013.

According to CSA (in the WMS report, 2012), twenty five percent of all Ethiopian households are headed by women. In this survey, out of the total 335 sample households, the 260 (77.61%) households are male headed and the rest 75 (22.39%) households are female headed households. And as far as the marital status of the sample household heads is concerned, most of the

household heads (285 or 85.07%) are married and the rest 50 (14.93%) household heads are single. Of all the household heads in the sample, 307 (91.64%) household heads are employed. Specifically, out of the 307 employed household heads, the majority, i.e. 122 or 39.74% of the employed household heads are self-employed, 95 (30.94%) heads are government employed, 78 (25.41%) heads are employed in private company and the rest 12 (3.9%) household heads are employed in non-governmental organizations (NGOs).

Table 4. 2 Summary statistics of variables used in the Propensity Score Matching (continued)

Variable name		*Percentage*	*Frequency*
Gender of household head	Male	77.61	260
	Female	22.39	75
Marital status of household head	Single	14.93	50
	Married	85.07	285
Employment status of household head	Employed	91.64	307
	Unemployed	8.36	28

Source: Author's own calculations, 2013.

The female headed households in the sample have slightly, statistically significant, lower average family size, 3.2, as compared to their male-headed counterparts for which the average family size is 3.77. And regarding the number of 18 years and younger family members, the average number for the female headed households is 0.95 whereas for the male headed households it is 1.42, which can be considered to be equivalent. Considering family income, the mean monthly income of the female headed households is Birr 2441.84 and that of the male headed households is Birr 3281.54. And considering the years of education there is a statistically significant difference among the female and male heads of households. Generally, the female headed households and male headed households in the sample are comparable regarding family size and number of children but the male headed households have Birr 839.70 more monthly income as a family on average than their female headed counter parts in the sample, which is a statistically significant and they are more educated than the female households.

Table 4. 3 Summery statistics of the outcome indicators used in Propensity Score Matching

Variable name	*Obs.*	*Mean*	*Std. dev.*	*Min*	*Max*
Wealth index	335	0.62	0.17	0.31	0.98
Monthly food expenditure per adult equivalent	335	708.04	541.89	109.89	4000
Incidence of sickness (yes=1)	335	0.29	0.45	0	1
Highest year of schooling of children	184	7.11	3.64	0	13
Proportion of children attending school (%)	194	88.49	28.73	0	100
Annual total education expense per attending child	179	856.39	1020.67	70	4500

Source: Author's own calculations, 2013.

Household wealth is approximated, as explained earlier, using 'wealth index' that reflects welfare of the household members in the sense of comfort related to their housing (number of rooms and whether their house has separate kitchen and separate children's room), their access to services (piped water, electricity, sewerage connection and cooking fuel) and their use of durable goods (such as radio, tape, TV, fridge, modern bed, table, chair, electric 'mitad', stove, sofa set, closet, cupboard, mobile phone and landline phone). This measure of household prosperity takes a value between zero and one, with a higher value showing higher household wealth. As it can be seen from table 4.3, the average wealth index of the sample households is 0.62 ranging from a minimum of 0.31 to a maximum of 0.98. The descriptive statistics in table 4.4 shows that there is a statistically significant difference in the average wealth index of the households in both groups. According to the result, households living in condominium houses have higher average wealth index, 0.78, than households living in rented houses whose average wealth index is 0.49. This shows that households living in condominium houses are wealthier than their counterparts living in rented houses.

One characteristic of the sample households can be revealed by their food expenditure. The average monthly food expenditure of the households is Birr 1798.96. As compared to the mean monthly income, Birr 3093.55, the households spend Birr 1798.96, on average, on food items which is 58.15% of the average monthly income. From this it can be deduced that the households under the survey spend most of their monthly income on food. This might be due to the fact that the households who apply for the condominium house are those from the category of low or

middle income households. And looking at the food expenditure per adult equivalent of the sample households, the average value is Birr 708.04 per month. As it can be observed from Table 4.4, there is no statistically significant difference between the two groups of households regarding this welfare indicator.

As table 4.3 shows, the average incidence of sickness is 0.29 ranging from 0, which means that the household did not have any member sick at least once over the 12 months period prior to the date of interview, to 1, with incidence of sickness. And, of the total households covered in the survey, 28.96% (97 households) reported that they had at least one member with health problems, sick, at least once over the 12 months period prior to the date of interview. When the two groups of households are compared, descriptively, regarding this indicator, the result shows that there is no significant difference.

Education is a key determinant of individual opportunities, attitudes and economic and social status. Education becomes very important when it comes to children. From the result in Table 4.3, the average of the highest year of schooling of 4-18 years old children in the sample households is 7 years stretching from a minimum of 0 (a child who goes to kindergarten) to 13 (12+1). Looking at the result in Table 4.4, there is no statistically significant evidence about whether the two groups of households differ in terms of this indicator of welfare.

And the average proportion of school age (4-18 years old) children attending school, for the sample households, is 88.49%. There is significant difference in proportion of children attending school between the two groups of households, as it can be seen from Table 4.4. The average proportion of school age children attending school is lower for the households living in condominium houses (83.99%) than for those living in rented houses (93.37%). But, the average total education expense per attending child is higher for those households living in condominium houses, Birr 1243.63 per annum, than of their counterparts, Birr 464.81. This difference is statistically significant.

Table 4. 4 Comparison of outcome variables by participation

Variable name	*Obs.*	*Households*	*Mean*	*Std.Err.*
Wealth index	150	Living in condominium house	0.776	
	185	Living in rented house	0.496	
		Difference	0.28***	0.0116
Monthly food expenditure per adult equivalent	150	Living in condominium house	669.00	
	185	Living in rented house	739.69	
		Difference	-70.69	59.503
Incidence of sickness (yes=1)	150	Living in condominium house	0.293	
	185	Living in rented house	0.286	
		Difference	0.007	0.0499
Highest year of schooling of children	94	Living in condominium house	6.755	
	90	Living in rented house	7.489	
		Difference	-0.734	0.535
Proportion of children attending school (%)	101	Living in condominium house	83.99	
	93	Living in rented house	93.37	
		Difference	-9.38**	4.0837
Annual total education expense per attending child	90	Living in condominium house	1243.63	
	89	Living in rented house	464.81	
		Difference	778.82***	141.37

Source: Author's own calculations, 2013.

Notes: ***statistically significant at 1%, **statistically significant at 5%.

4.2 Econometric Results

4.2.1 Estimation Strategy

This study, as mentioned earlier, uses cross-sectional data and subjects these data to PSM to control for selection bias in the hope of providing more reliable impact estimates. PSM matches beneficiaries to non-beneficiaries on the basis of observable characteristics and compares outcomes between the treatment sample and the sample of matches (Becker and Ichino, 2002). The underlying assumption is that there is no selection bias due to unobservable characteristics (Becker and Caliendo, 2007 and Nannicini, 2007), though, whether this assumption holds is questionable; this is examined using sensitivity analysis of the PSM results which can suggest whether (and to what extent) the estimated average treatment effects are robust to possible deviations from this assumption (Nannicini, 2007).

In the PSM method of generating average treatment effects on the treated, the first step is to estimate the propensity score for each observation. The propensity score, as stated earlier, measures the probability of participation given a set of observed covariates. The control variables used in obtaining the propensity score are those household characteristics not affected by program participation. The probability of participation is thus estimated using these control variables that describe household characteristics. By formulation, it is a binary qualitative response model (or limited dependent variable model) that can conveniently be estimated with the maximum likelihood estimation method using the cumulative distribution function (CDF) through the probit estimation that uses the normal CDF, or the logit model, which uses the cumulative logistic function (Gujarati, 2003). The logit model has comparative mathematical simplicity than the probit model (Gujarati, 2003). The logit model uses the (cumulative) logistic distribution function and it can be computed as (Gujarati, 2004):

$$P(x) = Pr\,(D = 1/X) = \frac{1}{1+e^{-X\beta}} = \frac{e^{X\beta}}{1+e^{X\beta}} \ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Where Xβ represents the explanatory variables and the coefficients

In the case of this study, a treatment dummy denoting whether the households live in condominium house or in rented house is created. This dummy is used as a dependent variable and assumes a value of 1 if a household owns and lives in condominium house and a value of zero if a household does not own a condominium house and lives in rented house. Accordingly, the propensity score for treated and control observations is estimated using the logit model as shown in Table 4.5.

Table 4. 5 Logit regression of the probability of selection

Independent variables	Coefficient	Standard error
Gender of household head	-0.557	0.3595
Age of household head	0.1088	0.0837
Age2	-0.0009	0.0009
Marital status of household head	1.499***	0.4899
Education of household head	0.3298***	0.1147
Educ2	-0.0057	0.0062
Employment status of household head	-1.5764***	0.5839
Family income	0.00008	0.00009
Family size	0.1284	0.119
Constant	-5.725***	1.84
Number of observations	335	
LR Chi2(9)	76.85***	
Prob>Chi2	0.0000	
Pseudo R-squared	0.1668	

Source: Author's own calculations, 2013.

Notes: ***statistically significant at 1%. Age2 and educ2 represent age of household squared and education of household squared, respectively. Please also note that the name "selection" is used instead of participation because the beneficiaries are compared with applicants to the program.

Table 4.5 presents the logit regression estimating the probability of living in condominium houses. The logit model is required to predict the propensity scores so that the matching procedure can be implemented. The control variables used in the model are 'gender', a dummy

variable indicating if the household head is male or otherwise, 'age' of the household head, 'marital status', a dummy variable indicating if the household head is single (=0) or married (=1), 'education' which shows years of schooling of the household head, 'employment status', a dummy variable indicating if the household head is employed or not, 'family income' which is the monthly family income in Birr and 'family size' showing the number of persons in the household. The results presented in Table 4.5 show that the main variables associated with selection that are statistically significant are marital status of the household head, education of household head and employment status of household head. Being married and more years of schooling positively affect the probability of selection into the program whereas being employed has a negative effect on the probability of selection in to the program. As the table shows some of the control variables are individually statistically significant and the entire relationship is also significant as explained by the Chi-squared test. However, the R-squared (goodness of fit) is small, 16.68%, indicating low explanatory power of the model, but it does not affect the validity of the model (Gujarati, 2003).

4.2.2 Estimated Results

The findings with respect to selected hypotheses are presented in this section. For estimating the impacts PSM is applied using the commands for propensity score matching (att^*) developed by Becker and Ichino (2002) and using the four matching algorithms.

Before discussing the results presented in Table 4.6 in more detail, a few remarks with regard to the implementation of PSM are required. The basic idea of matching is to compare a beneficiary with one or more non- beneficiaries who are similar in terms of a set of observed covariates X. This requires predicting propensity scores for each individual, i.e. beneficiaries as well as non-beneficiaries using logit or probit model. The logit model is used in this study, presented in Table 4.5, to predict those propensity scores. And, before estimating the average treatment effects, whether the propensity scores obtained fulfill the common support condition and the balancing hypothesis is examined. Becker and Ichino (2002) express the balancing hypothesis as follows:

$$D \perp X \mid P(X) \ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

According to them, this hypothesis indicates whether observations with the same propensity score have the same distribution of observable (and unobservable) characteristics independently of treatment status, i.e. whether treated and control units are on average observationally identical. The other condition is the common support or overlap condition, which, according to Nannicini (2007), ensures that for each treated unit there are control units with the same observables:

$$\Pr(D=1 \mid X) < 1 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (9)$$

According to Becker and Ichino (2002), imposing the common support condition in the estimation of the propensity score may improve the quality of the matches used to estimate the average effects.

The program Pscore.ado, used in this study, estimates propensity score and tests the balancing hypothesis. It tests whether the means of each characteristic are equal between treated and control units within each interval which is a necessary condition for the balancing hypothesis. The result of pscore for this study shows that the balancing hypothesis is satisfied. Moreover, to crosscheck the matching quality of pscore, t-tests[7] are used to examine the differences of the mean values for each covariate X across treatment and control groups. In addition, those t-tests calculated a 'bias' defined as the mean value of the treatment group and the (matched or unmatched) control group divided by the square root of the average sample variance in the treatment group and the (matched or unmatched) control group. The t-tests employed indicate that the differences as well as the 'bias' are reduced in most cases. Hence, the matching process was successful in generating a control group that was reasonably similar to the treatment group. Generally, it can be concluded that the balancing properties of the propensity scores are satisfied which means that there is no selection on observables. The option common support is used when running pscore which implies that the test of the balancing property is performed only on the observations whose propensity score belongs to the intersection of the supports of the propensity score of treated and controls. The program identifies the observations in the common support

[7] Pstest is used; the result is presented in appendix D.

when this option is used and that these observations are used when estimating the impacts. Thus, the condition of common support is satisfied in this case.

Table 4. 6 PSM impact estimates of some of the outcome indicators

Impact indicator	*Matching method*	*ATT*	*Standard error*
Wealth index	Nearest neighbor matching (random draw)	0.233***	0.025
	Radius matching, radius 0.1	0.256***	0.014
	Kernel matching, bandwidth 0.06	0.237***	0.015
	Stratification, blocks 6	0.232***	0.017
Monthly food expenditure per adult equivalent	Nearest neighbor matching (random draw)	-37.708	74.960
	Radius matching, radius 0.1	-51.528	48.913
	Kernel matching, bandwidth 0.06	-34.393	38.236
	Stratification, blocks 6	-47.798	53.990
Incidence of sickness of household members	Nearest neighbor matching (random draw)	-0.073	0.084
	Radius matching, radius 0.1	-0.031	0.057
	Kernel matching, bandwidth 0.06	-0.040	0.061
	Stratification, blocks 6	-0.033	0.063

Source: Author's own calculations, 2013.

Notes: ***statistically significant at 1%. The results in this table refer to the differences in the mean values between matched samples. The results are bootstrapped with 100 replications.

After obtaining the propensity score and checking that the balancing assumption is satisfied, the observations are matched according to their propensity score and the average treatment effect on the treated (ATT), or the impact of the program, using impact indicators are estimated. Because of the fact that exact matching is not possible (Becker and Ichino,2002), as shown earlier, four matching methods of inexact matching where treated and control observations are matched on the basis of closeness of their propensity scores are used. In nearest neighbor matching, each

treated observation is matched with its nearest neighbor, in terms of propensity score, in the control group. Radius matching matches each treated observation with those control observations lying within a pre-specified radius of the propensity score of the treated. In kernel matching, all treated observations are matched with a weighted average of all control observations. In stratified matching, the whole sample is divided into blocks based on closeness of propensity scores and then differences of outcome between participants and nonparticipants are computed for individual blocks and these results are summed for the whole sample.

ATTs are estimated through matching of treated and control observations. In all four matching methods, the treated group contains 150 observations. These results reflect the differences between beneficiaries and non-beneficiaries. It can be seen that the impact estimates vary, though not substantially, because of the different matching algorithms applied. ATTs are not statistically significant for monthly food expenditure and incidence of sickness. Thus, it can be concluded that there is no statistically significant evidence as whether the housing program has effect on food expenditure of households, as measured by per adult equivalent food expenditure per month and on incidence of sickness, as measured by whether the household had at least one member sick at least once over the 12 months period prior to date of interview. The result for incidence of sickness is encouraging regarding the sign of the coefficient, showing negative relationship between living in condominium houses and incidence of sickness, although it is statistically insignificant.

However, Table 4.6 shows that ATT of wealth index is significant and positive. The coefficient of wealth index is significant in all of the matching algorithms. Moreover, in four of the algorithms, the result is significant at 1 percent significance level. According to the result, the wealth index of households living in condominium houses increased by 0.232 to 0.256. Generally, from the result, it can be concluded that the condominium housing program has made the households living in condominium houses wealthier.

Table 4. 7 PSM impact estimates of children's education attainment[8]

Impact indicator	*Matching method*	*ATT*	*Standard error*
Annual total education expense per attending child (in Birr)	Nearest neighbor matching (random draw)	641.190**	272.203
	Radius matching , radius 0.1	595.994***	217.254
	Kernel matching, bandwidth 0.06	502.124**	205.390
	Stratified matching, blocks 6	555.450***	200.022
Highest level of schooling of children	Nearest neighbor matching (random draw)	1.511*	0.912
	Radius matching , radius 0.1	0.556	0.670
	Kernel matching, bandwidth 0.06	0.609	0.636
	Stratified matching, blocks 6	0.689	0.813
Proportion of school age children attending school (%)	Nearest neighbor matching (random draw)	-6.436	6.520
	Radius matching , radius 0.1	-7.819	5.146
	Kernel matching, bandwidth 0.06	-7.577*	4.513
	Stratified matching, blocks	-5.352	6.370

Source: Author's own calculations, 2013.

Notes: ***statistically significant at 1%, **statistically significant at 5%, *statistically significant at 10%. The results in this table refer to the differences in the mean values between matched samples. The results are bootstrapped with 100 replications.

In the study, it is tried to measure the effect of the condominium housing program on children's education. Education of children is measured by the highest level of schooling of the school age children, by the proportion of children attending school, and by the annual total education expense per attending child. The results for highest level of schooling of children and the

[8] Different specifications are used to estimate the propensity score, the results are presented in Appendix D.

proportion of school age children attending school are not statistically significant. This implies that there is no significant evidence as whether the housing program affects these outcome indicators. But, the effect on the annual total education expense per attending child is statistically significant and positive. The ATT of this outcome indicator is statistically significant in four of the matching methods although the significance level varies. As Table 4.6 shows, the total education expense of the households living in condominium houses has increased from Birr 502.10 to Birr 641.20 per school attending child per annum.

These econometric results confirm some of the hypotheses made when this study is initiated. The hypotheses about wealth of households and educational attainment of children, as explained by the dimension annual total education expense per attending child, are proved to be true from the result that shows significant effect of the program on these welfare indicators. However, the result does not show significant effect of the housing program on the other welfare indicators (food expenditure per adult equivalent, incidence of sickness and children's education explained by highest level of children's schooling and by the proportion of school attending children). Thus, there is no significant evidence to confirm or prove wrong the hypotheses about these indicators.

4.3 Sensitivity Analysis

The impact evaluation needs to answer the question whether the effects estimated are due to living in condominium houses or some unobserved characteristic of the households living in the condominium houses as compared to the control group. PSM allows control for observable characteristics included in the propensity score on which treatment and control groups are matched. The matching method relies on the Conditional Independence Assumption (CIA) or unconfoundedness assumption which states that all variables simultaneously influencing participation decision and outcome variables should be observed. If there are unobserved variables that simultaneously affect assignment to treatment and the outcome variable, a bias might arise to which matching estimators are not robust (Becker and Caliendo, 2007). Since estimating the magnitude of selection bias with non-experimental data is not possible, this problem is addressed by different sensitivity analysis approaches like the bounding approach proposed by Rosenbaum (2002) and the simulation-based sensitivity analysis for propensity-score matching estimators proposed by Ichino, Mealli and Nannicini (2007). Ichino, Mealli and

Nannicini (2006) (cited in Duvendack, 2010) argue that the presentation of matching estimates should be accompanied by sensitivity analysis.

The simulation-based sensitivity analysis, employed in this study, simulates a potential confounder in the data in order to assess the robustness of the estimated treatment effects with respect to deviations from the Conditional Independence Assumption (Nannicini, 2007). Using this analysis, the robustness of the baseline estimates to specific sources of failure of the CIA can be assessed by comparing the estimates obtained with and without matching on the simulated confounder.

One of the central assumptions of the simulation-based sensitivity analysis is that the unconfoundedness assumption does not hold given the set of covariates, but CIA holds given the covariates and an unobserved binary variable U and the ATT can be consistently estimated (Nannicini, 2007):

$$E(Y_0|\, T=1, X, U) = E(Y_0|\, T=0, X, U) \quad \ldots\ldots (10)$$

where Y_0, X and U are the potential (untreated) outcome, observed covariates and the unobserved binary confounder, respectively. In order to simulate the potential confounder U in the data, its distribution is fully characterized by the choice of four parameters (Nanicini, 2007):

$$P_{ij} = Pr(U=1|T=i, Y=j) = Pr(U=1|T=i, Y=j, X) \quad \ldots\ldots (11)$$

with i and j taking the value of either zero or one, which give the probability that U=1 in each of the four groups defined by the treatment status and the outcome value. Then, given values of the parameters P_{ij}, a value of U is attached to each unit and the simulated U is then included in the set of matching variables used to estimate the propensity score and to compute the ATT. Finally, a simulated estimate of the ATT, which is robust to the failure of the CIA implied by that particular configuration, is retrieved (Nannicini, 2007).

This approach can be implemented using the sensatt program in STATA (Nannicini, 2007); this procedure uses the value of the parameters P_{ij} configured to calculate a simulated point ATT estimate which is robust to the failure of the CIA implied by that particular configuration. The program displays the associated outcome effect (Γ) and selection effect (Λ) of the simulated confounder as an additional output of the sensitivity analysis[1]. These measures of the observed effects of U on the untreated outcome and the selection to treatment allow the researcher to discuss the plausibility of the existence of a similar confounder. "If only "implausible" confounders drove ATT to zero or away from the baseline estimate, the sensitivity analysis would support the robustness of the matching results" (Nannicini, 2007).

In choosing the parameters P_{ij}, the simulation exercise under which a grid of different P_{ij} is built to capture the characteristics of those potential confounders that would derive the baseline ATT estimates to zero or away from the baseline result is used. Moreover, in investigating how sensitive the baseline estimates are with respect to a possible existence of an unobservable variable that affects both the potential outcome and selection to treatment a "dangerous" confounder, i.e. a confounder that has positive effect on the potential outcome and selection to treatment (Nannicini, 2007), is simulated.

Using this approach a table of simulated ATTs, the d and s values[9], and the associated outcome and selection effects are prepared for the outcome indictors that show significant effect. Table 4.6 shows that the nearest neighbor matching estimate for wealth index of households is 0.233 which is significant at 1%. This suggests that households living in condominium houses have significantly more wealth index than households living in rented houses. However, this may not be due to living in condominium houses *per se* but unobserved characteristics that account for changes in the outcome even in the absence of such difference. The simulation-based sensitivity analysis explores the robustness of this impact estimate. A table of simulated ATTs such that d increases by 0.1 and s increases by about 0.9 along each column is built looking for those configurations that derive the ATT to zero.

[9] $d=P_{01} - P_{00}$ which measures the effect of U on the untreated outcome, $s = P_{1.} - P_{0.}$ this measures the effect of U on the selection into treatment.

Table 4. 8 Sensitivity analysis for Wealth index

Simulated ATTs	d	s	Γ	Λ
0.226	0.1	0.29	2.407	4.114
0.218	0.2	0.38	4.025	5.782
0.213	0.3	0.46	4.578	7.945
0.199	0.4	0.55	11.718	12.279
0.172	0.5	0.64	44.790	22.722

Source: Author's own calculations, 2013.

Two cases from Table 4.8 are enough to show the sensitivity analysis of the outcome, wealth index. In the third case, even though U is associated to very large selection and outcome effects (Λ=7.9 and Γ=4.6), the simulated ATT is still close to the baseline estimate (only 10.5% of the baseline ATT is explained by U). Further, in the fifth case, U is simulated so that it displays a very (and implausibly) large outcome effect (Γ= 44.8) and a selection effect of 22.7. However, U explains only 27.7% of the baseline estimate. These simulation exercises support the robustness of the matching estimate.

The nearest neighbor matching estimate for total annual education expense per attending child of households is Birr 641.190 which is significant at 5% as Table 4.7 shows. According to this result, households living in condominium houses pay significantly more money per annum for their children's education than those households living in rented houses. A table of simulated ATTs and associated outcome and selection effects of the simulated U is also prepared for this outcome indicator.

Table 4. 9 Sensitivity analysis for total annual education expense per attending child

Simulated ATT	d	s	Γ	Λ
378.326	0.1	0.28	2.377	4.692
345.284	0.2	0.37	3.059	5.946
248.751	0.3	0.45	5.482	8.307
78.794	0.4	0.53	51.587	12.292

Source: Author's own calculations, 2013.

In the third case, the simulated U displays large outcome and selection effects (Γ=5.5 and Λ=8.3). Here, the simulated confounder explains 60.1% (623.713-248.751/623.713=0.601) of the baseline estimate. And in the other case U is simulated so as to display outcome and selection effects of 51.5 and 12.2 respectively. To let U explain about 87% of the baseline estimate, with the outcome and selection effects. The presence of a confounder with similar characteristics can be considered implausible in this setting, where the set of observed covariates is rich. Generally, the simulation exercises support robustness of the matching estimate of the annual total education expense per attending child of the households.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusions

Since 2005, Ethiopia started implementing an ambitious Integrated Housing Development Program. It is a large-scale approach to address the current housing deficit, the poor quality of the existing housing stock, and the future housing needs due to continued urbanization. The targets of the program are the low and middle income households, who typically live in precarious housing situations. It allows the low and middle income households to access improved housing. Through the construction of durable, fully-serviced housing units, the program greatly improves their living conditions and their access to basic services. The houses are distributed to the beneficiaries through a computer lottery method. Most of the beneficiary households in the sample took the houses through this method and female household heads are also benefited more based on the principle that female heads of a household should be given priority in the 20-30 percent of the houses.

This thesis evaluates the impact of the condominium housing program on welfare of households. It contributes to the impact evaluation of condominium housing programs regarding the welfare effects that can be attributed to the program, on which much has not been done. Although the official government documents do not explicitly list the expected program outcomes other than the avoiding of overcrowding and the improvement of the quality of housing, this paper rather tried to measure welfare impact of the program using some selected welfare indicators, wealth of the households, food expenditure, health status of the household members and schooling of the households' children based on a cross-sectional data from 335 households in Mekelle, who applied for the houses.

The first step builds on descriptive analysis of the household characteristics to have some image about the difference in welfare between the two groups of sample households. According to the descriptive analysis, households living in condominium houses have higher wealth index which

reflects that participants of the housing program are wealthier than households living in rented houses. There is also a significant difference between the two groups regarding the proportion of children attending school which shows that the proportion of school age children attending school is higher among the children of those households living in rented houses than that of the beneficiary households. However, households living in condominium houses spend more money per attending child per annum than their counterpart households living in rented houses.
Among the variables used to estimate the probability, only marital status of the household head, education of the household head and employment status of the head of the household have statistically significant effect. Marital status and education of the head of the household positively affect the probability, i.e. married household heads with more years of schooling have more probability of being beneficiary of the program. However, employment status negatively affects the probability of selection showing that the household heads that are unemployed have more probability. The other variables, gender and age of the household head, family size and the monthly family income are expected to have significant effect. But, these variables are found to have no significant effect on the probability of selection.

The estimation result shows that condominium housing program has positive and quite significant effect on wealth of households approximated by wealth index including housing condition of the households, their access to services, and their use of certain consumer durables. It shows that the program increased the wealth index of participant households as compared to non participants. Furthermore, the result confirmed that the program has positive and significant effect on one of the dimensions of children's schooling: the total annual education expense per attending child of the households living in condominium houses is higher than for those without the program. However, no statistically significant effect was found with regard to the other welfare indicators; the effects of the program on food expenditure, on health and on children's education, indicated by highest level of children's schooling and the proportion of school age children attending school, are not statistically significant.

Based on the PSM results presented, the first impression is that this assessment is indeed accurate. However, as this matching method heavily depends on an identifying assumption which says that selection to the program is only based on observed characteristics, it may not

fully control the unobservable characteristics. This is tested using the sensitivity analysis, only on the results which are statistically significant and the testing result shows that the matching estimates are robust to deviations from this underlying assumption as the simulated unobserved confounders that drove the estimates away from the baseline results are implausible. This supports the fact that because both groups of the households are from those who applied for the houses, they are similar in terms of the characteristics that drove them to apply for the condominium houses.

5.2 Recommendations

Comprehensive impact evaluation of pro-poor programs that shows the change in the life of the beneficiaries due to participation in the programs should be undertaken. Building on an accurate evaluation of the impact of programs helps those concerned with the program to react to what is really happening. Particularly, measuring as accurately as possible the impacts of an intervention helps to understand the processes of intervention and their impacts so as to improve those processes. The condominium housing program is one of the pro-poor programs being implemented in Ethiopia targeting the low and middle income households in urban areas. Evaluating the welfare effects that can be attributed to the housing program is important to see what the program is achieving besides solving the housing shortages. Of course, the direct goal of the program is to help the low and middle income households to access better quality houses equipped with basic services. Based on the empirical findings, the following policy implications are drawn to expand the beneficiaries of the program and to facilitate the welfare impact of the program.

The program was expected to have significant impact on the welfare of the beneficiary households. However, according to the result, the effect of the program on food expenditure, health status of household members and children's schooling, as explained by proportion of school attending children and by the highest level of schooling of children, is not statistically significant. This may be because of the case that these outcome indicators may not be directly affected by the program, the case that the beneficiary households are paying for the houses.

Moreover, the program could have showed the expected effects had it been given with other additional interventions that improve the life of the urban poor households.

As the result this study shows housing program has positive effect on improving the life of the urban low income households by increasing wealth index and education expense for children, beyond solving the housing shortage, who otherwise live in poor quality houses with limited access to basic services. Thus, in order to reach the poor households not covered by the program policy makers need to work hard for expanding the program.

In this research it is tried to evaluate the welfare effects that can be attributed to the condominium housing program. However, a lot remains to be done in this area for future research. Thus, the following are suggested:

- When trying to evaluate the welfare impacts of the program, only certain indicators of welfare of the households are considered. But, the well-being of households may change in many other ways due to the program. Therefore, much effort should be exerted to assess the impact of the housing program on other welfare dimensions.

- The time span, since the households started living in the condominium houses which is only three years, may not be enough to reflect the impact of the program on welfare of the households since wealth creation takes time. Moreover, the cross-sectional data used in the study may not correctly reflect the impact of the program. As a result, this study may not be holistic measure of the impact of the program, to draw policy implications. Thus, the program should be assessed taking long time span and using panel data.

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Appendices

Appendix A. Survey Instrument

MEKELLE UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

QUESTIONNAIRE

INTRODUCTION TO THE RESPONDENT:

This questionnaire is designed by a postgraduate student of Economics (Development Policy Analysis) in the Department of Economics, Mekelle University to collect the required primary data so as to undertake a study entitled as **'Welfare Impact of the Condominium Housing Program in Mekelle'** in 2013. Your responses will be kept confidential and have a great deal of importance increasing the accuracy and reliability of the study so as to draw policy recommendations which may be used as a supportive input for continuining or improving the housing program.

Mahder Halefom

Questionnaire Code ……..

I. **Household characteristics**:-

Socio-demographic characteristics

1. Gender: 0=Female
   1=Male
2. Age (in years) …….
3. Marital status: 0=Single
   1=Married

Socio-economic status

4. Educational level (preferable in years)……..
5. Condition of activity : 0=Employed
   1=Unemployed
6. Occupation type: 0=Self-employed
   1=Government employed
   2=privately employed
   3=NGO
7. Family income (Birr per month) ……
8. Family size in number…….

s/n	Name/ code	Age	Attending school	Highest level of schooling	School source	School fee (Per month)	Total education expense per year

Note: school source: Government school

Private school

If all of your school age children (4-18 years old) are not attending school, please explain why.

……..

……

……

II. Housing condition:-

9. Where are you living? 0=Rented house and for how many years?
   1= Condominium house and for how many years?
10. Did you have any information about the condominium housing program when it was started? 1=Yes
    0=No
11. Did you apply for a condominium house when the program was first introduced? 1=Yes
    0=No
12. If your answer to the above question is 'yes', what was the reason behind that made you apply for the house? (You can choose more than one answer).
    Affordable housing
    Better quality house
    The freedom of having own house
    Better sanitary facilities
13. Did everybody in your household agree when you decided to apply for the program?
    1=Yes
    0=No

If no, how was the situation? …….....

……

14. If you did apply for a condominium house, have you got the house? 1=Yes
    0=No
15. If yes, how did you get the house?
    By order of application
    By lottery method
    Priority because of displacement
    Priority because of being a female head
16. If you are still living in a rented house, how much is the monthly payment?
17. If you are still living in a rented house, is there any change in the rent (price) after people have moved into the condominium houses?
    1=Yes and your estimated change in birr……and direction……

0=No

18. If you have got the house you applied for, are you living in it? 1=Yes
    0=No

19. If no, what did you do with the house? 1=Rented it out
    0=Sold it out

If you are living in a condominium house **of your own**, please reply to the following questions.

20. What is the type of your condominium house? 0=Studio
    1=One bedroom
    2=Two bedroom
    3=Three bedroom
21. How much do you pay, monthly, for the house? Birr 151.30
    Birr 224.59
    Birr 330.75
    Birr 529.38

If you pay other than these monthly payments, please specify the amount ……

22. How much were you paying, if you were living in a rented house (you can express the payment in interval)? ……
23. How much was the down payment for your house? Birr 3000
    Birr 10815
    Birr 14175
    Birr 18250

Other, please specify ……

24. Were you able to pay the down payment by yourself? 1=Yes
    0=No
25. If yes, did you pay the down payment at once (full payment) or did you pay it part by part?

……

26. If no, how did you pay the down payment? Was there any help from the government? How?

……

27. Have you fully paid the total price of the house? 1=Yes

0=No

III. Materiality conditions:-

Materiality condition	Yes=1	No=0	Monthly payment
Do you have access to piped water			
Do you have access to Electricity			
Do you have a sewerage connection			

28. If you are living in a condominium, how do you compare the freedom of using the piped water with the situation when you were living in a rented house?

……
……
……

29. If you are living in a condominium, is there any difference in the monthly payment for piped water as compared to what you have been paying when living in rented house? If yes, please estimate the difference.

……

30. If you are living in a condominium, how do you compare the freedom of using the electricity with the situation when you were living in a rented house?

……
……
……

31. If you are living in a condominium, how do you explain the difference in the monthly payment for electricity? ……

……

32. How do you explain the quality of your house?

……

……

33. How many rooms do you have in your house?

……

34. Is there a separate room used as a kitchen in your house? 1=Yes
0=No

35. Is there a separate children's room in your house? 1=Yes
0=No

36. What is your main source of energy for cooking? Electricity
Gas
Charcoal, gas and firewood

Other, please specify ……

37. Where is the nearest **fixed telephone** that is used by the members of your household?
Inside the dwelling
In the neighbor's house
Telephone not accessible

Other, please specify …….

IV. Living standard:-

38. Food expenditure

38.1 How many meals per day do your household members eat (in a non-fasting season)?

Three times

Four times

Other, please specify …….

38.2 How much is the total monthly food expenditure of your family?

……

39. Asset accumulation

Furniture and Household durables	Quantity	Year obtained
Radio		
Tape-recorder		
Television		
Refrigerator		
Beds (Wooden/Metal)		
Tables		
Chairs		
Electric ‘mitad’		
Stove		
Sofa set		
Closet (‘kumsatin’)		
Cupboard (‘acuhut mederderi’)		
Mobile phone		

40. Health

40.1 Was there any sick child in your household in the last 12 months? 1=Yes

0=No

40.2 If yes, how many times was the child (each child, for more than one sick child) sick? ……

40.3 Was there any sick adult in your household in the last 12 months?

1=Yes, how many? ....., how many times? ……..

0=No

40.4 Where did you go for treatment? Nearest hospital

Nearest health center

Nearest pharmacy

Other, please specify …….

40.5 How much was spent on treatment in the last 12 months?

……

Finally, those of you who are living in condominium houses, please reply to the following questions:

41. Do you think that the program's package design (the criteria for getting the house, the timing and manner of the payment and other issues) is appropriate? Please, explain why?

……

……

……

42. What do you think about the quality of the house?

……
……

……

43. If you have any recommendation on the quality of the house or regarding the application of the housing program, please reflect.

……
……
……
……

Thank you!!!

Appendix B: Formula of the four matching algorithms. (This section draws on the article by Becker and Ichino (2002).)

The formula for both nearest neighbor matching and radius matching can be written as follows:

$$ATT^{M} = \frac{1}{N^{T}} \sum_{i \epsilon T} [Y_i^{T} - \sum_{j \epsilon C(i)} wij\ Yj^{C}]$$

Where, M = stands for either nearest neighbor matching or radius matching.

T = the set of treated units.

N^{T} = the number of units in the treated group.

Y_i^{T} = observed outcome of the treated units.

Y_j^{C} = observed outcome of the control units.

C (i) = the set of control units matched to the treated unit i with an estimated value of the propensity score. Nearest neighbor matching sets

$$C(i) = \min_j \| P_i - P_j \|$$

this is a single set unless there are multiple nearest neighbors. P_i and P_j are propensity score of treated and control units, respectively.

In radius matching,

$$C(i) = \{Pi | \| P_i - P_j \| < r\}$$

i.e. all the control units with estimated propensity scores falling within a radius r from P_i are matched to the treated unit i.

The kernel matching estimator is given by:

$$ATT^{K} = \frac{1}{N^{T}} \sum_{i \in T} \left\{ Yi^{T} - \frac{\sum_{j \in C} Yj^{C} G\left(\frac{P_j - P_i}{h_n}\right)}{\sum_{k \in C} G\left(\frac{P_k - P_i}{h_n}\right)} \right\}$$

where G (.) is a kernel function and h_n is a bandwidth parameter.

The estimator of ATT based on the stratification method is computed with the following formula:

$$ATT^S = \sum_{q=1}^{Q} ATT_q^S \frac{\sum_{i \in I(q)} D_i}{\sum_{\forall i} D_i}$$

where q = the blocks defined over intervals of the propensity score.

I (q) = the set of units in block q.

Q = the number of blocks.

Appendix C: Calculation of outcome indicators.

Appendix C1: Wealth Index

The wealth index (WI), as it is calculated here, is a composite index that reflects the welfare of household members in terms of the quality of the dwelling, use of durable goods and access to basic services. The index ranges from zero to one with a higher value indicating more wealth.

It is calculated as a simple average of three indices: housing quality index (HQ), consumer durables index (CD) and services quality index (S).

$$WI = (HQ+CD+SQ)/3$$

Housing quality index (HQ) is a simple average of:

1. The number of rooms per person as a continuous variable,
2. A dummy variable equal to one if the housing unit has a separate kitchen,
3. A dummy variable equal to one if the housing unit has a separate children's room.

Consumer durables index (CD) is calculated as a non-weighted average of 14 consumer durable dummy variables, each equal to one if a household owned radio, tape recorder, television, refrigerator, modern bed, table, chair, electric 'mitad', stove, sofa set, closet, cupboard, mobile phone and landline phone.

Services quality index (S) is also calculated as an average of three dummy variables equal to one if the housing unit has electricity, piped water into the dwelling and sewerage connection and a dummy variable equal to one if the household uses electricity or gas for cooking.

Table C1.1 Construction of the wealth index

Components of index and score	**Contributing variables**
H=Housing quality index (/3)	rooms per person, separate kitchen, separate children's room
CD=Consumer durables index (/14)	radio, tape, TV, fridge, modern bed, table, chair, electric 'mitad', stove, sofa set, closet, cupboard, mobile phone and landline phone
S= Services quality index (/4)	electricity, water, sewerage, cooking fuel

Appendix C2: Calculation of food expenditure per adult equivalent.

Table C2.1 Adult equivalence scale

Years of age	*Men*	*Women*
0-1	0.33	0.33
1-2	0.46	0.46
2-3	0.54	0.54
3-5	0.62	0.62
5-7	0.74	0.70
7-10	0.84	0.72
10-12	0.88	0.78
12-14	0.96	0.84
14-16	1.06	0.86
16-18	1.14	0.86
18-30	1.04	0.80
30-60	1.00	0.82
60+	0.84	0.74

Source: calculated from the World Health Organization (1998) by Stefen Dercon (cited in Woldehanna et al. (2008)).

Appendix D: Annex to the main results.

Table D1 Result of pstest after matching for the outcomes wealth index, food expenditure and health

Variable	*% bias*	*t-value*
Gender	-11.7	-1.11
Age	-2.1	-0.19
Age2	-3.2	-0.28
Marital status	-4.1	-0.51
Education	1.8	0.17
Educ2	-1.2	-0.10
Employment status	7.5	0.59
Family income	-11.2	-1.01
Family size	-1.4	-0.12
MeanB=4.9		

Source: Author's own calculations, 2013

Table D2 Logit regression of propensity score to estimate ATT for the outcome education expense per attending child

Independent variables	*Coefficient*	*Standard error*
Age	-0.1693	0.1251
Age2	0.0016	0.0013
Education	0.2508	0.1786
Educ2	-0.0001	0.0097
Employment status	-2.2007***	0.8521
Family income	0.00001	0.00001
Constant	3.3665	3.0007
Number of observations	179	
LR Chi2(6)	52.09***	
Prob>Chi2	0.0000	
Pseudo R2	0.2099	

Source: Author's own calculations, 2013.

Table D3 Logit regression of propensity score to estimate ATT for the outcome highest level of schooling of children

Independent variables	*Coefficient*	*Standard error*
Age	-0.1243	0.1209
Age2	0.0010	0.0013
Education	0.1108	0.1524
Educ2	0.0064	0.0088
Employment status	-2.606***	0.7914
Family income	0.0001	0.0002
Constant	3.6626	2.9499
Number of observations	184	
LR Chi2(6)	49.49	
Prob>Chi2	0.0000	
Pseudo R2	0.1941	

Source: Author's own calculations, 2013.

Table D4 logit regression of propensity score to estimate ATT for the outcome proportion of children attending school

Independent variables	*Coefficient*	*Standard error*
Gender	-0.4990	0.4732
Age	-0.1239	0.1292
Age2	0.0011	0.0013
Education	0.1756	0.1557
Educ2	0.0029	0.0088
Employment status	-2.4398***	0.8206
Family income	0.0002	0.0002
Family size	0.0365	0.1742
Constant	3.3623	3.0479
Number of observations	194	
LR Chi2(8)	52.93***	
Prob>Chi2	0.0000	
Pseudo R2	0.1970	

Source: Author's own calculations, 2013.